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Original to Government

Secrt. IE-27—60,000 31 10 50.

Development (1953) Department.

MS. SERIES.

G.O. NO. 2289

Dated 15-5-53

passed by Govt

FOR MYSORE STATE

[Despatch Abstract.]

Mines - Geological Survey of India - Progress report for the field season 1951-52 - Geology of and Mineral investigation of Hospet Taluk, Bellary District by Sri M. ~~Krishnamurthy~~ Krishnamurthy, Asst Geologist, Gr. S-9 - Published

No. 52188-M / 398(10) MK/51-52 Calcutta 13, the 27th April 1953.

From

THE DEPUTY DIRECTOR,
GEOLOGICAL SURVEY OF INDIA,
27, Chowringhee,

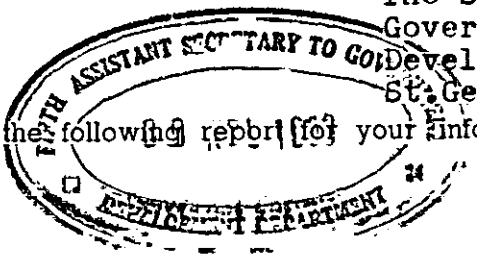
To

The Secretary to the
Government of Madras,
Development Dept. Fort.
St. George, Madras.

Sir,

I am forwarding herewith ~~a copy~~ 3 copies of the following report for your information and record.

Kindly acknowledge receipt.



Title of the report :

" Progress report for the field season 1951-52. The Geology and Mineral Investigation of Hospet Taluk, Bellary district, Madras State, " by Mr. M.Krishnamurthy, Assistant Geologist, Geological Survey of India.

56128 J
30.4.53.

Kept below

Yours faithfully,
P. Mukherjee
for Deputy Director,
Geological Survey of India.

KB:25/4

No.....

Calcutta-13, the..... 195

Copy, together with a copy of the report is forwarded for information to.....

.....

The receipt may kindly be acknowledged.

Deputy Director

To [illegible]
[illegible]
2.5.53

Dept (J) Deptt 3

Letter No. 56128 J/53-1 d 2-5-53.

compared
[illegible]
04/5

To the Deputy Director
geological Survey of India
27, chowringhee, calcutta 13.

Sir,

Sub: Mines - geological Survey of India Report entitled "Progress report for the field season 1951-52. The Geology and Mineral Investigation of Hospet Taluk, Bellary district, Madras State by Shri M. Krishnamurthy, Asst geologist G.S.9.

Ref:- Your letter No. 5288-M/398(10) MK/51-52 d 27.4.53

I am directed to acknowledge the receipt of three copies of the report mentioned above

y.o.

Note:- After issue, a review of the report will be submitted

-14
16/5 I

Devt (J) Dept

Sub: Mines - Geological Survey of India Progress report for the field season 1951-52 - Geology of and Mineral investigation of Hospet Taluk, Bellary District by Sri M. Krishnamurthy, Asst. Geologist, G.S.I. - Published.

Read: From the Dy Director, G.S.I., No. M.5288 M/398(10) MK/51-52 dated 27-4-53.

G.O.Ms. 2289 dated 15-5-53

The Geological Survey of India report entitled "~~the~~ Progress report for the field season 1951-52: Geology and Mineral investigation of Hospet Taluk, ~~Geology~~ Bellary district" by Sri M. Krishnamurthy will be published in the Fort St George Gazette.

11/5/53

12/5/53

P.T.O

To The S.G.P for publication of the report in the

9.5.53 F.S.G. (Furthereds)

P.T.O.

To the D.G & C.
(with encl)

Copy to the supdg
Geologist, G.S.I.,
Southern circle
Madras-4.

Copy to the Dy Director
G.S.I.
27, Chowringhee
Calcutta 13.

1121

Devt (J) Dept

Memo No. 56128 J/53-2 dt 14-5-53

Sub: Mines - geological survey of India - Progress report for the field season 1951-52 - geology of and Mineral investigation of Hospet Taluk, Bellary district by Sri M. Krishnamurthy, Asst geologist, G.S.9

An esctract from the above report relating to "Tungabhadra Dam" is forwarded to the C.E.(9) I

To the C.E.(9) I
[with esctract of 'S' on pp 9-10 of (T)]
Copy to P.W. dept

Issued. 2.3.53.

P.W. (I & P)

UNOFFICIAL NOTE. No 41 4/2-6-53.

Geology and Mineral Investigation of Hospet Taluk, Bellary.

The following is a summary of the report by Sri M. Krishnamurthy of the Geological Survey of India on "The Geology and Mineral Investigation of Hospet Taluk".

The chief metallic minerals found in the area surveyed, viz., 370 sq. miles, in the Hospet Taluk, Bellary District, are:--

Iron ore:- This is found along the northern flanks of the Sandur Hills between the former State border and the great spur of Jambunath; the total available ore here is estimated to be 50 lakh tons. It is also found about a mile south of Kallahalli around .2933 ridge; the reserves are estimated to be about 10 lakh tons.

Manganese ore:- Two miles south of Kallahalli, low grade manganese ore occurs associated with lateritoid haematite on the top of the hill about 5 furlongs south east of the .2933 ridge. The reserves of ore are estimated at about 10,000 tons.

Galena:- Galena of good quality occurs five furlongs west of 25/4 milestone on Bellary-Kampli Road.

Building Stones and Road Metals:- There is unlimited supply of hard massive granitoids in Hospet taluk, which are used for road metalling and building purposes.

Kankar:- Small patches of Kankar of fairly good quality occur between Papinayakanahalli and Hospet, on either side of the railway line to Bellary and on the Hospet-Bellary Road. It is estimated that about 5,000 tons could be had from this area.

Red Silt:- The soft, red coloured soil adjoining Hospet-Gauripura road embankment is used for Surkki manufacture in the Tungabhadra dam constructions.

AR 30.5.53

4/2.6.53.

GOVERNMENT OF MADRAS.
P.W. (Information & Publicity) Department.
::::

UNOFFICIAL NOTE NO. 41 DATED 2ND JUNE, 1953.

(Unofficial Notes are issued to serve as background material and on the understanding that the source will not be referred to in any way in what is published).
::::

GEOLOGY AND MINERAL INVESTIGATION OF HOSPET TALUK, BELLARY.

The following is a summary of the report by Sri M. Krishnamurthy of the Geological Survey of India on "The Geology and Mineral Investigation of Hospet Taluk".

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MANGANESE ORE:- Two miles south of Kallahalli, low grade manganese ore occurs associated with laterite haematite on the top of the hill about 5 furlongs south east of the .2933 ridge. The reserves of ore are estimated at about 10,000 tons.

GALENA;- Galena of good quality occurs five furlongs west of 25/4 milestone on Bellary-Kamli Road.

BUILDING STONES & ROAD METALS:- There is unlimited supply of hard massive granitoids in Hospet taluk, which are used for road metalling and building purposes.

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RED SILT:- The soft, red coloured soil adjoining Hospet-Gauripuram road embankment is used for Surkki manufacture in the Tungabhadra dam construction.

Issued by
The Director of Information & Publicity,
Government of Madras.

sr.2.6.

To issue
23.7.53.

Devt (J) Dept

117/27/7

Letter No. 92789 J/53-1 dated 23.7.53.

To The Dy Director
Geological Survey of India,
27, Chowringhee, Calcutta. 13

Compo 99/27/7

Enclosure (with encl

Sir,

Sub:- Geological Survey of In
- Progress report for the fiel
season 1951-52 - geology an
Mineral investigation of Hos
Taluk, Bellary District by Sri
Krishnamurthy, Asst geolog
G.S.9.

I am directed to forward herewi
two proof copies of the report mentione
above for carrying out necessary
corrections and to request that the pro

P.K. 14

may kindly be returned duly checked at an early date.

Yours faithfully,

22.7.53

22/7/53

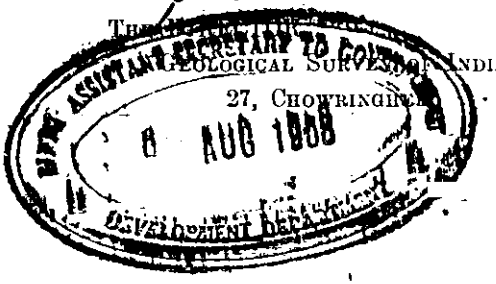
22/7/53

GOVERNMENT OF INDIA.

98818

No. 3866 M/398(10)MK /51-52 Calcutta 13, 8 August, 1953.

FROM Deputy



To
The Superintending Geologist-in-Charge,
Southern Circle,
Geological Survey of India.

Subject:- "Progress report for the Field Season 1951-52 - Geology and Minerals investigation of Hospet Taluk" Bellary district, by Mr.M.Krishnamurthy, Assistant Geologist, Geological Survey of India.

Dear Sir

I am sending herewith a copy of letter No. 92580 J/53-1, dated the 23rd July, 1953, from the Deputy Secretary to the Government of Madras, Development Department, to this office, together with two proof copies in original of the above report for necessary check and corrections and request that these may please be returned direct to the Deputy Secretary to the Government of Madras, Development Department, Fort St. George, Madras, under intimation to this office.

Yours faithfully,

Sd/-
for Deputy Director,
Geological Survey of India.

K.C:4/8.

P.T.O.

No. 8865 -M/398(10)MK/51-52 Dated: Aug. 1953.

Copy forwarded for information to the Deputy Secretary to the Government of Madras, Development Department, Fort St.George, Madras, with reference to his letter quoted above.

for Deputy Director,
Geological Survey of India.

Devt dept

To AS

Please see the copy of the letter from the Dy Director G.S.9. on pages 3-4 above. Proof copies from the Supdg Geologist may be awaited till 1-9-53.

7/8/53

7/8/53

7/8/53

Reg.

GOVERNMENT OF INDIA

No. 1520/56. Dated 19th August, 1953.

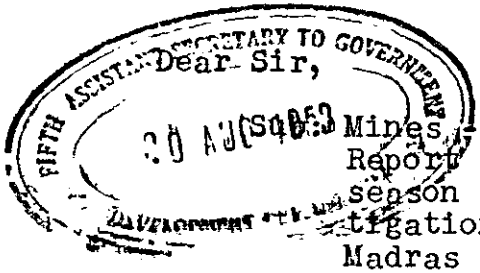
FROM

The *Superintending Geologist*,
Geological Survey of India.
Southern Circle,
Madras-4.

To:

The Deputy Secretary to the
Government of Madras,
Development Department,
Fort St. George,
Madras-9.

19130



Dear Sir,

Subject: Mines & Minerals - Geological Survey of India - Report entitled "Progress Report for the field-season 1951-52 - The Geology and Mineral Investigation of Hospet taluk, Bellary district, Madras State" by Mr. M. Krishnamurty, Assistant Geologist, Geological Survey of India - Correction of proof copies.

Please refer to your letter No. 92580 J/53-1 dated the 23rd July, 1953, to the Deputy Director, Geological Survey of India, Calcutta.

I am returning herein the two proof copies of the above report after carrying out the necessary corrections.

Kindly acknowledge receipt.

Yours faithfully,

M.S. Balasundaram

(M.S. Balasundaram)
For Superintending Geologist,
Geological Survey of India.

Encl: As above.

ARS

No draft to issue
GM
26.8.53

Fair draft

Devt (J) Dept 19

Memo No. 92580-J/53-2 dated 26.8.53.

Sub: Geological Survey of India - Progress report for the field season 1951-52 - The geology and Mineral Investigation of Hospet taluk, Bellary district, by Sri M. Krishnamurthy, Asst geologist, Geological Survey of India - Proof copies

107-108/N 7/8

Typed/Vidhi

Two proof copies of the above report mentioned above ~~is~~ are forwarded to the S.G.P. He is requested to publish the above report in the Fort St George gazette and intimate the fact to Govt

Copy to 2/9/53

GM 25.8.53

To The S.G.P. (with encls)

Typed/dtw

26/8/53

P.T.O.

To him SMR 26.8.53

Letter No. 92580 J/53-3 dated 26-8-53.

1.7-108 26/8

To The Superintending Geologist,
2nd Geological Survey of India
Southern circle, Madras 4.

Sir,

Sub Geological Survey of India -
Report entitled "Progress report
for the field season 1951-52 -
The geology and Mineral
Investigation of Hospet taluk, Bellary
district by Sri M. Krishnamurthy,
Asst geologist, G.S.I. - Proof copies

Ref:- Your letter No. 1520/56 dated 19.8.53 pr 5 c.

I am directed to acknowledge the receipt of the two copies of the report mentioned above

26/8/53 y.b

1-53 25/8

21/9

10 FS

(Memo on page 7 above)

The report has been published at pages 9- 13 of ~~Part I of the~~ the Supplement to Part I of the F.S.G. Gazette dated 9th September 1953. The papers may be lodged and added to the G.O at (M)

2281
15-5-53

15/9/53.

15/9/53

15/9/53

GOVERNMENT OF MADRAS
DEVELOPMENT DEPARTMENT
***

Copy of letter No.G.F. 111666/53,dated 11-9-1953, from the Controller of Stationery and Printing, Madras, to the Secretary to Government.

Sub: (1) Geological Survey of India - Report entitled "Progress Report for the field season 51-52" by Sri N.Gopalakrishnamurthy, Assistant Geologist:

(2) Report entitled "Progress report for the field season 51-52 - Geology of parts of the Tirupattur taluk, Ramanathapuram District". by Sri V.Gopal, Assistant Geologist;

(3) Progress report for the field season 51-52 - the Geology and Mineral Investigation of Hospet taluk, Bellary District by Sri M.Krishnamurthy, Assistant Geologist, and

(4) Report on the detailed examination of limestones useful for cement manufacture in the northern part of Kurnool District by Sri N.V.B.S.Dutt, Assistant Geologist - Publication - Intimation of:

Ref: (1) Memorandum No.87357.J/53-2,Development, dated 28-8-1953.
(2) Memorandum No.87356.J/53-2,Development, dated 20-8-1953.
(3) Memorandum No.92580.J/53-2, Development, dated 26-8-1953, and

(4) Memorandum No.99100.J/53-2,Development, dated 29-8-1953:

The Geological reports mentioned above have been published at pages 1 to 23 of the Supplement to Part I (Issue No.36+A) of the Fort St.George Gazette, dated 9th September 1953.

/True Copy/

Development(J)Department

No. 56128 J/53.

Sub: Mines - Geological Survey of India - Progress report for the field season 1951-52 Geology and Mineral investigation of Hospet Taluk, Bellary District by Sri M.Krishnamurthy, Asst.Geologist, G.S.I.

Ref: From the Dy.Director G.S.I, No.5288-M/ 398(10) MK/51-52, dated 27-4-53:

To A.S.

The Dy.Director G.S.I., has forwarded a copy of the report entitled "The goelogy and Mineral Investigation of Hospet Taluk, Bellary District" by Sri M.Krishnamurthy Asst.Geologist, G.S.I. The report is noted on below.

The area surveyed ~~lies within the latitudes 15° 0' and 15° 15' 76° 45' and covers about 370 sq.miles in~~ is 370 sq miles in the Hospet Taluk. The following are the chief metallic mineral found in the area.

Iron Ore: The Ore is found along the northern flanks of the Sandur Hills between the former State border and the great spur of Jambunath; the total available ore here is estimated to be ~~60~~ 50 lakhs tons. It is also found about a mile south of Kallahalli around 2933 ridge; the reserves are estimated to be about 10 lakh tons.

The iron ore occurs as heamatites associated with banded ferruginous quartzites in the soft red ochreous shales and argillities. The cost per ton of ore varies between Rs.15/- to Rs.17/ ~~f~~ f.o.r. or Rs.8 to Rs.9 at the pits mouth. The nearest railway stations are Hospet and Papinayakanahalli.

The author states that there is a mad scramble for plot containing iron ore for lease among the people who are naturally interested in getting a good return in a short time, that this kind of temperament has led to an unhealthy competition and litigations among the different parties, that it would be desirable to stop granting licenses indiscriminately to avoid wasteful methods of mining and unhappy litigation and that it is necessary to have a regular check on the mining activity in Bellary District by Govt.

C No

9
13/5

Managanese Ore: Two miles south of Kallahalli, low grade manganese ore occurs associated with lateritoid haematite on the top the hill about 5 furlongs south east of the.2933 ridge. The ~~xxxxxx~~ reserves of ore are estimated at about 10,000-tons.

Galena: Galena of good quality occurs five furlongs west of 25/4 mile stone on Bellary-Kampli Road.

Building Stones and road metals: There is unlimited supply of hard massive granitoids in Hospet taluk which ~~are~~ was used for road metalling and building purposes.

Kankar: Small patches of Kankar of fairly good quality occur between Papinayakanahalli and Hospet, on either side of the railway line to Bellary and on the Hospet - Bellary Road. It is estimated that about 5000 tons could be had from this area.

Red Silt: The soft, red coloured soil adjoining Hospet-Gauripuram road embankment is used for Surkki manufacture in the Tungabhadra dam constructions.

The author gives a short note of the geology of Tungabhadra Dam site. Regarding water supply the author states that the wells in the area are very deep and water is brackish.

The report contains important information regarding the occurence of economic minerals. It may be published in the T.S.G. Gazette for the information of the public. An extract relating to Tungabhadra Dam site may be sent to C.E.(I) for information. A draft order and a draft memo are submitted for approval.

After issue this may be sent to P.W.(I & P) for the issue of a note to the press.

A

12.5.53

14/5/53

14 MAY 1953

Issued as G.O.Ms. 2289 Dev dt 15.5.53.
Memo No. 56128 J/53-2 dt 14-5-53.

To AS

The file may be sent to P.W. (94P) with reference to 'A' on page 2 above

65626

K 21/5/53

P.W. (I & P)

CM 20.5.53

Lr 20.5.53

Devt w.o. 65626 J/53-1
21.5.53.

A draft unofficial Note on Geology and Mineral Investigation of Hospet Taluk is put up. The case may be returned to Devt a.i

AR 20.5.53

Corp. 6

Dev (ai)

X Issued.

Three copies of leo note are placed below.

DR 3/6/53

(I & P) Leo 4045/131
" 2.6.53.

Devt dept

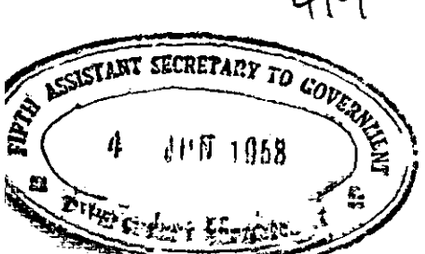
Ws 71545 D/53
4/6/53

To 6

WS from p1 ante may be perused

With reference to 'x' on p1 ante a call book entry (W 11/10/53) may be made. and the file may be closed as Go ms 2289 Dev dt 15.5.53

K 10/6/53



P S to F

6 10/6/53

Lr 10.6.53

Entered in C.B. ass. No. 1001
CM 10.6.53

F - 1422 (1)

GEOLOGICAL SURVEY OF INDIA

PROGRESS REPORT FOR THE FIELD SEASON 1951—52

THE GEOLOGY AND MINERAL INVESTIGATION OF HOSPET TALUK, BELLARY DISTRICT, MADRAS STATE.

By

M. KRISHNAMURTHY,
Assistant Geologist, Geological Survey of India.

Progress Report for the Field-season 1951-52

THE GEOLOGY AND MINERAL INVESTIGATION OF HOSPET TALUK, BELLARY DISTRICT, MADRAS STATE

By

M. Krishnamurty, M.Sc.,
Assistant Geologist,
Geological Survey of India.

****

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Communications

Hospet town is centrally situated and is connected both by road and railway with other adjoining taluk headquarters. But the inter-village communications are poorly developed.

III. GEOLOGICAL FORMATIONS

The probable sequence of the formations met with in the area is as follows:-

	Recent and Sub-Recent	Recent and Sub-Recent soils and alluvium of Tungabhadra river
ARCHAEANS		Dolerites Quartz veins Pink granites and pegmatites (equivalent of the Closepet granites) Biotite-granitoids and other foliated gneisses (equivalent of the Peninsular gneisses)
	Dharwars	Epidiorites and epidiorite-schists, banded ferruginous quartzites, phyllites enriched with iron and manganese-ores and, hornblende-schists

Hornblende-schists.-These rocks occur as admixtures, lenses and patches amidst epidiorite-schists in the granitoids as around Emmiganuru, Kampli and Gunda. Adjoining granite intrusions, they show admixture of considerable amount of quartz and orthoclase. Under the microscope they show pargasite variety of hornblende, granular quartz and orthoclase. Acid plagioclases and biotite occur in subordinate amounts. Hornblende shows alteration to biotite and in some sections to chlorite.

Phyllites, ferruginous shales and ferruginous quartzites are well developed south of Papinayakanahalli and in the north-western continuation of Sandur range of hills around Kallahalli. Another small inlier intruded by two dolerite bands is noted adjoining Daroji. Caught up bands of shales which have partly metamorphosed to phyllites occur two miles east of Garaga.

Ferruginous quartzites are of two varieties. They are (1) the regular sedimentary deposit occurring with the shales and (2) the silicified and ferruginous traps. Both the varieties are well jointed, brittle and banded. The first one occurs as bands on the top of the Sandur hill ranges between Hospet and Papinayakanahalli, running in a general N.W.-S.E. direction but show constant undulations along the strike. They are banded and the individual layers show minor puckerings and folds. Enrichment in many places of good quality haematite in them is quite common. The potentialities of iron-ore will be dealt in under economic geology. The ferruginous quartzites are in places cherty, but exhibiting banding and folding. The ferruginous quartzite bands are wide apart at the border of the former Sandur State, but come close together and thin out near Gauripuram. All the bands of the northern limb die out one mile south of Hospet but those of the southern limb continue far into the Hyderabad State.

The second variety occurs as thin bands on the top of the small low lying hills. They are very poor in iron content and nowhere do they show any enrichment of iron-ores as in the case of the first variety. They appear to merge gradually

into the underlying epidiorites. They occur (1) two miles N.N.W. of and on the top of .2892 hill south of Metri, (2) on the top of the .1401 hill near Nalludi and .1428 hill 1½ miles east of Kampli, and (3) on the southern limb of the Sandur range, continuing into Hyderabad territory beyond the Tungabhadra river. Bruce Foote has termed these rocks as "trappoids" as they are black coloured on the weathered surface suggestive of induration. The rocks are however brittle It is interesting to note that the trappoid bands show undulation along strike causing variation in dip direction, due probably, to local disturbances. The amount of dip varies between 50 and 60°.

Under the microscope, it shows fine grained, equigranular, and firmly interlocking grains of quartz, iron-ore and felspar. Big grains of augite altered to actinolite bordered by accessory garnet are seen in the groundmass.

Epidiorites and epidiorite-schists are massive, highly weathered, poorly jointed and dull coloured rocks. The outcrops are covered mostly by black cotton soil and where exposed they occur as massive sheets unlike the bouldery outcrops of dolerite.

Epidiorite-schists admixed with gneisses are developed in force, around Kampli, Nalludi and along the Tungabhadra river between Aralehalli and Suguru. The strike varies from N.N.W.-S.S.E. as at Kampli to W.N.W.-E.S.E. as at Suguru, dip being 50°-60° eastward. Both the northern and southern slope and the valleys of the Sandur ranges show epidiorites. The north-west end of the Copper Mountains extends as epidiorites as far as Metri where they thin out but reappear as schistose bodies northward.

The contact of the granite-Dharwar boundary is seen (a) along the Metri-Daroji road between 21 and 24 milestones, (b) one mile south of Hospet, (c) south of Papinayakanahalli and along the southern margin of the Sandur hill ranges between Gauripuram and Gunda. Elsewhere the boundary is mostly concealed by soil.

The intrusive relationship of the granite to the Dharwars becomes evident from the following facts:-

(1) In the stream section at the 24th milestone along the Metri-Bellary road, the granite and pegmatite alternate with bands of epidiorite, the granitic injections having been along the foliation planes of the epidiorite. The epidiorite-schists thin out at Metri, but reappear discontinuously as caught up lenses and patches in the granitoid between Metri and Ramasagaram. Their contact with the granitoids is sharp and the epidiorite becomes brittle and schistose showing under the microscope chilling effects. Apophyses of pegmatite and quartz veins cut across the epidiorites.

(2) Around Daroji and .1822 hill north of Metri, epidosites are seen developed in the vicinity of epidiorite-schist, probably due to the hydrothermal alteration during granitic intrusion. On the hills .1822 and .1892 near Metri, the epidiorite-schists have been silicified and enriched in ferruginous materials.

(3) At the contact with the porphyritic granite, some alkali materials of the granite have been incorporated into the epidiorite-schist giving rise to porphyroblasts of felspar laths aligned in a N.-S. direction.

Biotite-granitoids (equivalent of Peninsular gneisses).-The grey granitoids in the area could be divided into three groups based on their geographical distribution. They are (1) Nellapuram group, (2) Hampi-Bukkasagaram group and (3) Gundakanahatti group of hills. In all these groups, the Chilakanahatti group of hills. In all these groups, the granitoids are medium to fine grained, pale grey on fresh surfaces but showing a pale brownish pink after long exposure and are traversed by dolerite dykes of two different patterns. Boulders of huge size are strewn pell-mell in the area and the rocks show powerful joints in N.E.-S.W., E.N.E.-W.S.W. and W.N.W.-E.S.E. directions. Between Mariammanahalli and Chilakanahatti the granitoids either enclose or are traversed by bands of compact hornblende-schists and dolerites. These granitoids are in many places banded and streaky. The caught up hornblende-schist bands appear like a trap rock on weathered surfaces, due to compaction. Their contact is sharp and there are evidences of mylonitisation. Thin irregular veins of granite and pegmatite run across the hornblende-schist. On the southern margin of the former State of Sandur, the granitoids show repeated injections into the hornblende-schists resulting in an admixture of the two. The epidiorite has become schistose.

A typical microsection of the granitoid shows equigranular and hypidiomorphic texture. The minerals seen include quartz, acid plagioclases of the composition of albite-oligoclase with varying proportions of orthoclase. Microcline and biotite are subordinate and apatite is accessory.

Pink granites and pegmatites.-A thick zone of coarse grained pink felspar rock (pink granite) and pegmatite cutting across the granitoids and in turn traversed by dolerite dykes, is seen in force in the granitoid hills south, north and north-east of Nellapuram. The area between Basapuram and Rayarhalu is a gently undulating plain occupied by pink felspathic rock with occasional outcrops of massive coarse grained granitoids. Repeated injections of coarse grained granite and pegmatite alternating with epidiorite-schists are noted south of Ittigi and Ramasagaram. Bruce Foote called these injections "contemporaneous granites".

Four bands of pink pegmatites are noted along the dam line on the right bank of Tungabhadra river of which one is clearly seen intruding into the epidiorites at the right abutment of the dam (Photo I), two in between Ray and Turta canals and the fourth at the Hyderabad border. Besides these, three small thin bands traverse the river about half-a-mile south-east of Mudalapur. All along the western side, of the epidiorite bands in the Hyderabad area are traversed by coarse grained pegmatite. Another band is observed in the bed of the river three miles north-east of Kampli.

All these bands are of small size and show little influence on the character of the rocks they traverse. Generally they are very irregular in their thickness and small in length, ranging in size from mere strings to thick node-like bodies.

Under the microscope, the rocks show kaolinised and sericitised acid plagioclases in predominance, besides quartz and orthoclase. Sphene and zircon(?) are accessory.

Quartz veins.-Quartz veins are of two kinds. The first is the massive white to cream coloured and well jointed variety. They show basal cleavages and break into small plates. These occur (1) on the hill E.S.E. of Upparahalli, (2) on the western side of the epidiorite hill in Hyderabad near Bevinahalu, (3) west of Nidagurti on the hills .2360 and .2209, (4) around Nagalapuram Railway Station and Gunda Reserved Forest areas where the vein quartz and pegmatites are found injected into the epidiorites have become talcose and (5) one mile south of Kamalapuram on the top of the .1610 hill.

The second variety is the brecciated quartz and this is noted in the following places:-

(a) a great show of brecciated quartz-rock of brown to sea-green colour is seen on the top of the hills .1964 and .1968 west of Nellapuram,

(b) at the Dharwar-granite boundary one mile south of Hospet and

(c) brown to white coloured vein quartz in places brecciated occurs on the isolated hills near Chilakanahatti running discontinuously for three miles.

It is doubtful whether these bands represent any fault or shear zones. The brecciation, according to R.B. Foote, with whom I agree, seems to be a change of colour and translucency in the mass of the rock in shapes resembling those of included angular lumps rather than a true re-cementation of a once fractured rock.

It might be that these quartz veins are older than the dolerite dykes, but in only one case, is the contact between them has been met with, and in this case, the dolerite dyke cuts across the quartz run and at the contact is seen much admixture of the two.

Dolerites and dolerite porphyry.-Dolerites are compact massive and black coloured rocks standing out prominently like walls on the top of the granite hills. They also occur along the valleys and streams between granitoid hills. They cut across coarse grained pink felspar-rock and run for several miles and in some places branch off in anastomosing fashion maintaining generally all along, the same strike, as could be observed west of Daroji and Metri.

Two groups of dykes are seen in the area. The older(?), W.N.W.-E.S.E. trending dykes are traversed by the younger ones running in a N.N.W.-S.S.E. direction. The W.N.W.-E.S.E. trending dykes are numerous. At the contact where two dolerites intersect, they have become fine grained and appear glassy(?). Single instance of triangular dyke pattern is observed south of Nellapuram.

Dolerites occurring in the area can be divided mineralogically into the following three types:-

(1) Olivine dolerites
(2) Dolerites and dolerite-porphyries, and
(3) Quartz dolerites.

Olivine dolerites.-These are deep black coloured, medium grained rocks with needles of white and at times green felspar crystals amidst dark coloured pyroxene. They have a general W.N.W.-E.S.E. strike and dip at high angles. They show well developed joints and weather into small isolated boulders.

Olivine dolerites occur (a) 1½ miles south of Nellapuram running for about nine miles, and (b) about a mile north of Nellapuram amidst the huge granitoid hills; there are two dykes striking in a N.W.-S.E. direction.

A typical section of an olivine-dolerite shows under the microscope sub-ophitic texture, olivine filled in with magnetite dust, augite and hypersthene altered to a light green mass of chlorite which surrounds them and also traverses into the adjoining felspar laths as fine films and rods. The

cracks traversing the pyroxenes are filled with talc derived from pyroxenes themselves. Plagioclases are slightly sericitised and secondary biotite contains pleochroic haloes.

Dolerites and dolerite porphyries strike in W.N.W.-E.S.E. and N.N.W.-S.S.E. directions. Their contact with the granite is sharp and shows chilling. They are noted at the following places:-

(1) Near the 31 milestone on Kamalapuram-Nellapuram cart-track, is a dyke of dolerite running for about four miles in a N.N.W.-S.S.E. direction and cuts across the olivine dolerite;

(2) east of Venkatapuram another dyke runs discontinuously for about three miles and crosses the Tungabhadra river north-north-westward;

(3) west of Kadirampuram are two dolerite dykes running for four miles in a W.N.W.-E.S.E. direction;

(4) Danayanakere dolerite dyke extends for about six miles upto Gunda; and

(5) five dykes of about 1½ miles in length are developed around Potlakatte in a E.-W. direction.

Under the microscope the dolerite is ophitic, coarse to medium grained, changing to fine grain and consist of twinned augite and hypersthene, altering to hornblende and sericitised plagioclases. In some sections (71 b and 71 d) granophyre is developed at the contact of augite and plagioclase. Magnesite is accessory.

Quartz dolerites.-Quartz dolerites occur at the following places:-

(1) two dykes around Kariganur and Ingligi extend in a N.W.-S.E. direction for about four miles upto Vadrahalli, and

(2) small thin band near Vithala Swami temple in Hampi.

These are medium to coarse grained and under the microscope they show sub-ophitic texture and alteration of pyroxenes to green hornblende. Plagioclases are altered to a mass of sericite and zoisite and the released quartz occurs interstitially. Granophyre is developed at the contact of the pyroxenes with the plagioclases.

Recent and sub-recent formations.-All along the course of the Tungabhadra river is a widespread of alluvium, wherein paddy and sugarcane are grown. Around Emmiganuru and Metri is a thick black soil cover with local patches of red variety. Around Papinayakanahalli, Mariammanahalli and Chilakanahatti, the area is a gently undulating plain covered with red soil. In these places dry crops like maize, cholum, etc., are cultivated.

IV. ECONOMIC GEOLOGY

The chief metallic minerals found in the area in order of their abundance are good quality iron-ore, low grade manganese-ore and galena, besides inexhaustible supply of building stones of excellent quality and "kankar".

Iron-ore.-Iron-ore occurs as haematite associated with banded ferruginous quartzites in the soft red ochreous shales and

argillites. It varies from purple to dark grey in colour and is of very good quality. Local enrichment of red oxide in the shales is common. The ore is found at the following localities:-

1. Along the northern flanks of the Sandur hills between the former State border and the great spur of Jambunath; the total available ore here is estimated at about 50 lakh tons.

2. About a mile south of Kallahalli around .2933 ridge, the iron-ore is estimated to contain about 10 lakh tons. The calculation is based 16 c.ft. to a ton. In both the areas good quality float ore is present in plenty in the fields and it can be had by mere picking of it.

Representative samples of iron-ore analysed at the Geological Survey of India laboratories gave the following results:-

	Samples No.				
	H1/MKM	H2/MKM	H3/MKM	H4/MKM	H5/MKM
SiO_2	1.66	1.50	2.92	1.88	5.02
Total Fe as Fe_2O_3	95.94 (Fe=67.16)	97.40 (Fe=68.18)	93.31 (Fe=65.32)	95.54 (Fe=66.88)	92.96 (Fe=65.07)
P ...	0.052	0.041	0.068	0.044	0.015
S ...	0.013	0.021	0.037	0.017	0.032

	Samples No.			
	H6/MKM	H7/MKM	H8/MKM	M9/MKM
SiO_2 ...	2.00	0.81	1.90	1.67
Total Fe as Fe_2O_3	97.80 (Fe=68.46)	95.94 (Fe=67.16)	96.30 (Fe=67.41)	94.82 (Fe=66.37)
P ...	0.028	0.031	0.024	0.037
S ...	0.009	0.016	0.019	0.010

The cost per ton of ore, when I visited the area, varied between Rs.15/- to Rs.17/- f.o.r. or Rs.8/- to Rs.9/- at the pits mouth. The nearest railway stations are Hospet and Papinayakanahalli with a lead of about five miles, from where the ore is sent to Madras, Masulipatam and Visakhapatam harbours to be shipped to Japan, the main importer.

It is necessary to mention here that, of late, there is a mad scramble for plots containing iron-ore for lease among the people who are naturally interested in getting a good return in a short time. This kind of temperament has led to an unhealthy competition and litigations among the different parties. It would be desirable to stop granting licenses indiscriminately to avoid wasteful methods of mining and unhappy litigations. It is also necessary to have a regular check on the mining activity in Bellary district by the Government.

The limited supply of wagons and their non-availability to Madras and Mormugao harbours at the time of my visit had been the main concern of the lease holders.

F Manganese-ore.-Two miles south of Kallahalli, low grade manganese-ore occurs associated with lateritoid haematite in the red ochreous shales and argillites on the top of the hill, about five furlongs south-east of the .2933 ridge. From the surface indications, the reserves of ore have been estimated at about 10,000 tons. It is a mixture of pyrolusite, psilomelane and wad. The analysis of the ore is as follows:-

Sample name: Mn/MKM

SiO_2 ...	...	3.70
Total Fe as Fe_2O_3	...	24.24 (Fe = 16.97)
Total Mn ...	...	34.98

Mr. Vadde Nagappa of Bellary has taken lease of the area. Old workings could be seen in the area and the pits are not encouraging as to its extent in depth.

H Galena.-Galena of good quality occurs as disseminated lumps and masses, five furlongs west of 25/4 milestone on Bellary-Kampli road (57 A/11; 15°19'30" : 76°36'30"). The bed-rock was not revealed upto 10 feet depth in the few pits put by me. The only surface indication is the hard nodular kankar which is locally burnt for "chunnam". The area is a gently undulating plain surrounded on its west and north by hard massive granitoids traversed by dolerite dykes and enclosing caught up patches of epidiorite-schists. The ore does not seem to occur as a vein but the trend of the epidiorite-schists nearby is roughly W.10°N.-E.10°S. Plate No. I.1 denotes the location of trial pits for galena and the data collected are furnished below:-

Depth from surface below	Remarks
0 - 6 in.	Brownish black soil
6 in. - 1 ft. 7 in.	"Kankar" with lumps of galena of the size of 6" x 5" x 5"; 9" x 5" x 4"; 8" x 4" x 5" etc., besides small cubes.
1 ft. 7 in. - 4 ft. 2 in.	Soft "kankary" soil with boulders of galena of the size of 18" x 15" x 8".
4 ft. 2 in. - 6 ft.	Soft earthy and clayey soil with pebbles of weathered trap and quartz.
6 ft. 0 in. - 7 ft.	Soft earthy soil with small crystals of galena.

Pit P(1) - Shows small crystals upto 3 feet downward; soft "kankary" soil continues.

Pit P(2) - Only soft "kankary" soil upto 4 ft. 5 in.

Messrs. Prabhat Mining Co., Hospet, have taken prospecting license of the area. The lessee is advised to deepen the pits further down to assess the potentialities and extent of the metal. The analysis of the ore is as follows:-

Sample name: Pb/MKM

S	...	12.77
Pb	...	82.53
Ag	...	2.71 ounces per long ton.

Building stones and road metal.-There is practically no dearth for hard massive granitoids in Hospet taluk, which are used for road metalling and building purposes. The unlimited supply close at hand of these granitoids had a considerable influence on the architecture of Hampi, the old city of Vijayanagar dynasty, now in ruins. The granites of the Island quarry near the dam are quarried and utilised in the construction of the dam as they are fine grained compact and take good shapes on breaking. Dolerites in the area yield very good road metal but they are neglected because of difficulty in quarrying. Some of the varieties of vein quartz could be utilised as an ornamental stone in view of the pleasing green colour.

Kankar.-Small patches of kankar of fairly good quality occur at the following places between Papinayakanahalli and Hospet and the figures are taken from Mr. S. Krishnaswamy's report on "A Note on the Tungabhadra Dam Site and Project - June 1947".

(1) On either side of the Southern Railway line to Bellary

Between T.P. 168/6 and 168/14 ..	72,765	c.ft.
" " 168/20 and Bellary road	15,000	"
" " 168/20½ and 168/21½ ..	12,000	"

(2) On the Hospet-Bellary road between:

(a) Milestones 358/2 and 358/3 ..	67,500	"
(b) Near Vadrahalli village ..	60,000	"
	227,265	c.ft.

Since 45 c.ft. of this kankar go to make the long ton of 2,240 lbs. about 5,000 tons could be had from this area. This is being quarried and supplied to the Tungabhadra dam site for lime-surkhi manufacture.

Red silt.-The soft, red coloured soil adjoining Hospet-Gauripuram road embankment (or Rayarkere) is used for surkhi manufacture in the Tungabhadra dam construction. About 22,000 units of this red earth, I understand, is required for the project work.

Tungabhadra Dam

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The suitability of the site selected for the dam under construction across the Tungabhadra river, about three miles south-west of Munirabad railway station, known as the "Hoonoormurti" or "Malapuram dam site" has been reported on by R.B. Foote, Middlemiss, Vinayaka Rao and Mukherjee. In 1941, Drs. M.S. Krishnan and C. Mahadevan visited the area to examine the cores recovered from the bore-holes. In 1947, Mr. S. Krishnaswamy inspected the dam site to examine the foundation trench and the bore-holes. Recently Mr. M.S. Balasundaram submitted a note on the fissure zone at L.S. 1400 feet on the Madras side.

The present site near Malapuram (15°16' : 76°21') was originally selected in 1902-1903 by Mr. Mackenzie, the then

Superintending Engineer. It was considered to be one possessing strong foundations and good abutments. This site lies about 3¼ miles south-west of Hospet and about three furlongs west of Malapuram. Here the river is about 1375 feet wide and flows from south-west to north-east between two high spurs of the Sandur range of hills. The dam area consists of epidiorites and epidiorite-schists with thin bands of trappoids (ferruginous trap) enclosed in them. These are traversed by four thin pegmatites along the dam line. The epidiorites extend far into the Hyderabad territory and exhibit undulation in strike and consequent variation in dip direction. All along the dam alignment the rocks dip 50-60° upstream.

Canal excavation between Kandanayanahalli and Kanavetimmapuram is through hard granitoid hills which have weathered into big boulders. South of the milestones 14 and 15 on Hospet-Kampli road, Tungabhadra low level canal, negotiating difficult terrain, crosses two deep gorges by designed reinforced concrete aqueduct columns. Four furlongs downstream the canal enters a tunnel of 1126 feet length. Engineering details are not given here to avoid repetition, as the previous workers have already described them.

WATER SUPPLY

Around Daroji, Madapuram, Somalapuram etc., water table is fairly high and the wells are situated in jointed epidiorites and epidiorite-schists. But in Yalubenchi and Sri Rama Rangapuram, the bed rock is schistose gneiss and the water is also brackish. Villages like Rangapuram, situated adjoining Narihalla and Ramappa Vanka, depend mostly on stream water for drinking purposes. Water table near the stream courses is high and the recuperation in the wells is also fair as in Devasamudram and Javuku. In most of the villages around Emmiganuru is an extensive stretch of black soil with local patches of red variety. Water in these villages is brackish and the wells are very deep. It is interesting to note that Ramappa Vanka water all through its course is brackish, while that of Narihalla is potable. Brackishness may be due to the leaching of alkaline salts from the adjoining black soil country. In Ittigi, Manuru and Suguru, river water could not be used for cultivation due to the relative height of the ground and the wells in these places are also deep. In Kamalapuram, wells situated in epidiorites are deep and yield brackish water, but those in gneisses show good water at a fairly higher level. In Hospet, water table is very near the surface due to the vicinity of the Tungabhadra river. Around Papinayakanahalli, Sankalapuram, Kallahalli, Rajapuram and Mariyammanahalli, the wells are very deep as the bed rock is either the sparsely jointed epidiorite or granitoid.

The water level data in some of the villages with their geographical index are given in the appendix.

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APPENDIX

Water level data

Name of locality.	Latitude. ° '	Longitude. ° '	Surface level of water. (in feet)	Depth of water. (in feet)	Remarks.
Ballapur	15 22	76 41	15	6	Only one well in the village. Brackish water. Epidiorite rock. Stream water for drinking purposes.
Bukkasagaram	15 21	76 32	20-25	-	A few wells are brackish.
Chinnapuram	15 19	76 38	15-20	5	Recuperation fair.
Daroji	15 15	76 41	25	6	Bed rock epidiorite; recuperation fair.
Devasamudram	15 21	76 38	10	3-6	Well near the stream course.
Emmiganuru	15 24	76 42	15	5	Schistose granitoids in the wells; many wells show brackish water.
Garag	15 5	76 25	20	10	Biotite granitoids.
Gunda	15 9	76 24	30	10	Hard granitoids.
Guttiganuru	15 21	76 44	12	6	Two wells show brackish water.
Ittigi	15 28	76 41	15-18	10	Epidiorite in the wells.
Javuku	15 19	76 40	15	5	Well near the stream course.
Kallahalli	15 14	76 25	deep	-	Epidiorites - Water brackish.
N. end of Kamalapuram	15 19	76 29	15-20	10	Epidiorite in wells - Brackish water.
S. end of Kamalapuram	15 19	76 29	10-20	10	Granite-gneisses in wells. Water good.

Name of locality.	Latitude. o '	Longitude. o '	Surface level of water. (in feet)	Depth of water. (in feet)	Remarks
Madapuram	15 15	76 42	20-25	10	Bed rock trap in epidiorite; recuperation is fair.
Manuru	15 29	76 43	No well in the village.		Stream water for drinking purposes.
Mariammanahalli	15 10	76 21	30	5	Hard granitoids.
Mavinahalli	15 17	76 41			No well - Stream water is used by the villagers.
Metri	15 19	76 37	25	5	Bed rock, epidiorite; recuperatic is fair.
South of Metri	15 19	76 37	15	5-8	Well near the stream course.
Muddapuram	15 25	76 41	12-15	8	Only two wells; water savour; stream water for drinking purposes.
Nellapuram	15 18	76 34	deep	few feet	Hard, sparsely jointed granitoids.
Papinayakanahalli	15 14	76 30	25-35	-	Epidiorites and hard granitoids.
Pattanaserugu	15 20	76 44	15	3	Wells contain only brackish water. Fresh water from the Halla.
Sankalapuram	15 16	76 25	25-35	-	Epidiorites and hard granitoids.
Suguru	15 29	76 44	15-20	5	Water brackish; epidiorite bed rock; stream water for drinking purposes.
Sugganahalli	15 18	76 41	20	10	Recuperation good.
Sri Rama Rangapuram	15 19	76 44	10' near the stream 25	few feet	Village on high contour; well water